Chapter 3
Planning and Design Process

3-1. General

This part of the guidance addresses factors that are unique to the planning and design of prefabricated construction whereas Chapter 4 contains more specific engineering and construction issues. General guidance for the planning and design process is contained in ER 1110-2-1150.

3-2. Project Planing

Project planning will require combined efforts of the in-house planning, engineering, construction, operations, contracting and real estate functions, and possibly the services of expert consultants. Project team and project schedule are two key elements of project planning. The planning process for the design shall be consistent with the District's Project Management Plan (PMP) for the project.

a. Project development team. Planning and design for prefabricated construction of navigation projects requires the input and expertise of a multi-disciplinary team. It will be necessary to establish the nucleus of the Design Team early including the assignment of the Project Manager, Project Engineer, and key members from the technical/functional elements. Expert consultants and A/E partners should be selected as early enough to influence the Reconnaissance Phase and the Feasibility Study for the project. The team is responsible for establishing the needs of the customer, the alternatives that will be considered, funding or other constraints, engineering requirements for the project (criteria), required investigations, evaluation of results, and the selection of the best solution. The project team is ultimately lead by and responsible to the Project Manager (PM). The type of technical leadership may change during the various stages of the project, but a senior engineer should lead the design or evaluation study effort. A collaborative effort is especially necessary for innovative and state-of-the-art solutions. This effort should include technical experts to provide guidance and advice on concepts, details of implementation, assessment and mitigation of risks, engineering and construction requirements, and evaluation of results. This team should establish the scope of the entire study early in the design or evaluation process to ensure that resources are being used efficiently and to ensure that the investigations are compatible and complete. Planning and design of prefabricated navigation projects is a rapidly evolving and highly complex field, which requires special expertise and substantial judgment. In many instances, the project team should augment the in-house staff with technical experts to assure independent review of methodology and results, to add credibility to the results, and to assure public acceptance of the conclusions. Careful selection of expert consultants is essential, and the experience and qualification of these individuals must be consistent with the work for which they will be responsible. Such experts should have recognized experience with innovative marine design and construction. These experts may be from within USACE, other government agencies, universities, or the private sector. Technical experts should be included in the early team planning sessions to assist in identifying the scope of problems, selecting approaches and criteria, reviewing results and selecting interim and final parameters.

b. Project schedule. The PM, with input from the customer and team members, must develop a comprehensive schedule in the Project Management Plan (PMP) and maintain it throughout the project. The detail of the schedule shall be commensurate with the complexity of the work. Projects that employ innovative design/construction methods must thoroughly include all project requirements including planning, design, engineering, consulting engineer acquisition, construction, environmental and cultural resource, real estate acquisition, and proposed contracting strategy(ies), whether performed by USACE, the customer, or by contract. It is important that the schedule is realistic and consistent with available

funding and other resources. The Project Review Board (PRB) will approve the baseline project schedule.

3-3. Reconnaissance Phase or System Study

The Reconnaissance Phase or System Study identifies the problems being addressed and potential solutions. During this phase, economic viability and federal interest in the project are to be determined. Careful attention should be given to potential costs for each solution and associated risks. Prefabricated construction may require offsite construction of components and then near-site assembly of components. More widespread environmental, geotechnical, survey, and real estate studies may be required. A decision to proceed to a feasibility study is sometimes based on more conventional and perhaps higher cost alternatives, with other potentially less costly but more innovative solutions identified for future study. When the decision hinges on more innovative and less costly solutions, this should be clearly addressed and supported by expert opinion in the study effort. Required investigations may need to be completed early to develop a complete understanding of the cost for the project. In all instances, investigations or unusual studies, which will be required to complete future studies, must be defined at this time.

3-4. Feasibility Study

This study phase shall include preliminary analysis and design of the key features of the project in sufficient detail to prepare the baseline cost estimate, determine the contingencies, and provide a recommended plan for project authorization. More effort and study are to be expected for prefabricated construction because the available examples usually relate to traditional projects. The preliminary analysis should also be of sufficient detail to develop a design and construction schedule and to allow detailed design on the selected plan to begin immediately following approval of the feasibility report. Consideration must be given to adequately defining factors affecting the economic analysis such as filling and emptying systems, which may deviate from traditional systems. The alternative concepts must be developed to an equivalent level of contingencies to allow a fair evaluation. A life-cycle analysis in accordance with ER 1110-2-8159 may be required. Criteria for selecting the recommended plan must be determined. Factors that are not normally measured in terms of dollars, such as environmental impacts, should be included. Navigation project feasibility study effort may be performed as a stand-alone single-site study or as part of a river system study. Appendix D illustrates an example.

3-5. Final Design

a. Design Documentation Report. A Design Documentation Report (DDR) documents the final design of a project feature(s). A DDR is prepared as part of the preconstruction engineering and design phase or during the construction phase for multi-contract projects. Resources must be programmed to incorporate details of design that won't be established until the construction contract stage. Modifications during construction that require redesign should also be documented in a DDR. A brief narrative description of the project features and the design analysis methodology should be included. The narrative should also discuss the conceptual designs used as the basis for the selection of the features including type of structure, form or configuration, controlling loads, load combinations, and load paths. Temporary or intermediate construction stages and construction loads as well as final loads must receive special attention for prefabricated, precast navigation structures. All designs must be reviewed with respect to biddability, constructibility, operability, and environmental aspects. Materials and their properties used in the design of features should be clearly identified. Design information that is critical to the development of engineering considerations for construction and information for preparation of the Operation and Maintenance Manual should be included in the DDR. In some instances, models or mock-up construction may be necessary to determine construction methods and sequence prior to construction.

b. Plans and specifications. The development of plans and specifications for prefabricated construction projects includes some unique problems in addition to the normal function to convey project requirements. For projects that are unusual because of the size of precast elements or because of in-the-wet placement, a decision must be made regarding how comprehensive and detailed a plan may be needed to limit risks associated with the construction effort. Long-term efforts such as hydraulic physical model studies are normally accomplished prior to the construction contract stage. Attention must also be given to developing a plan that does not unnecessarily constrain potential bidders/offerers in areas such as equipment requirements for the construction effort. Precast prefabrication yard locations (and whether several projects might more effectively use a common location), whether slipways or graving dock facilities, are needed to "launch" large precast units. Transportation of units from the precast area to the final project location and construction interference with navigation traffic must be carefully planned. Construction and installation illustrations showing sequences and emphasizing critical procedures may be required to show intent to the potential bidders.

c. Acquisition strategy. The division of responsibility between the government and contractor shown in plans and specifications is influenced by the acquisition strategy and contract method that is selected. Therefore, it is necessary for the team to make an early decision on the contracting method to be used. In general, a request for proposal (RFP) method is applicable to most prefabricated construction of navigation projects. Selection criteria for award of the contract are important and must be developed by a comprehensive team, including engineering, construction, contracting, and other required expertise. For prefabricated construction, emphasis should be placed on criteria related to the demonstrated skill or experience of the contractor, access to heavy/special equipment, past overall construction experience, concepts for the project, and marine architectural expertise. The bidding period must allow time for contractor-designed items. Sealed-bid (low-bid) procurement methods should be limited to conventional projects or components of projects. Design-build contracting (ER 1180-1-9) is another possible acquisition strategy that has been used for a wide range of projects. This approach would require a clear, detailed definition of all of the performance requirements for the completed project. It is usually necessary to have all funding available at the time the contract is finalized.

3-6. Construction Phase

As more innovative and unique solutions are utilized in navigation construction, the designer must be more closely involved with the construction phase of the project. This includes assistance in assuring specification compliance, extensions of design engineering during construction, and addressing field problems. Any changes in fabrications, handling, storing, or transportation of prefabricated units must be closely coordinated with the designer. Additional funding must be planned for a greater involvement of engineers and specialists. Revisions to contract concepts may take place through the value engineering contractor proposal program. Evaluation efforts will be required for Value Engineering Change Proposals (VECP).

3-7. Operations Phase

Requirements for periodic inspection could be different for prefabricated elements compared to traditional construction. The final products of prefabricated navigation structures generally contain more connections than traditional construction; therefore, outward signs of distress may not be as obvious compared to traditional construction. This may require more detailed periodic inspections. Certain areas may require more attention, such as post-tension areas and buoyancy chambers. Some areas could require specific lighting and possible air quality monitoring for safe entry into confined workspaces (such as floating approach walls). Engineering performance problems shown by signs of distress must be detected early in order to arrest problems. Instrumentation requirements during construction and for long-term monitoring must be assessed. Inspectibility and monitoring must be considered and incorporated into the design and monitored in the periodic inspection program. O&M manuals may specify the need for

special automated or remote inspection features/tools. In some instances, prefabricated construction may improve operation and maintenance opportunities because items may be removed intact and replaced (like gates) with a like unit while maintenance takes place elsewhere.